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10/609,039

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Pei-Hung Chu

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8486

7590

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EXAMINER

LE, DUNG ANH

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/609,039

Applicant(s)

CHU, PEI-HUNG

Examiner

DUNG A LE

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5, 11-14 and 21-24 is/are rejected.
- 7) ☒ Claim(s) 6-10 and 15-20 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.


### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 June 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_ 6) ☐ Other: 

## DETAILED ACTION

### *Oath/Declaration*

The oath/declaration filed on 6/27/2003 is acceptable.

### *Drawings*

The drawings are objected to for the following reasons.

Figures 1a- 1d should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### *Specification*

The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

***Claim Objections***

Claim 20 is objected to because of the following informality: Claim 20 is depended by itself. Appropriate correction is required.

**Claim Rejections**

**Set of claims 1-10.**

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**Claims 1, 3, 4 and 5 are rejected under 35 USC 102 (b) as being anticipated by Lin et al. (6096594).**

**Regarding claim 1, Lin et al. teaches a method of forming a contact hole with a spacer, comprising the steps of:**

(a) providing a substrate 38 covered by at least a first dielectric layer 40, an etch stop layer 42 and a patterned photoresist layer 44; (figs 5A- E)

(b) etching the etch stop layer and the first dielectric layer using the

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patterned photoresist layer as a mask to form a contact hole 46 exposing the substrate 38;

(c) forming a conformal second dielectric layer on the etch stop layer 42 and in the contact hole; and

(d) anisotropically etching (col 4, line 17) the second dielectric layer 42 to form a spacer on the sidewall of the contact hole.

**Regarding claim 3**, wherein the conformal second dielectric layer 50 (silicon nitride, col 3, line 61) is etched at a greater rate than the etch stop layer 42 (silicon Oxide, col 3, line 34) in step (d).

**Regarding claim 4**, wherein the conformal second dielectric layer 50 (silicon nitride, col 3, line 61) is etched 20 or more times as fast as the etch stop layer 42 (silicon Oxide, col 3, line 34) in step (d).

**Regarding claim 5**, wherein the etch stop layer adjacent to the contact hole is not removed in step (d). (fig. 5D).

### **Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claim 2 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Lin et al. in view of Ho (US 2002/0110992 A1) .**

**Regarding claim 2,** Lin et al. teaches all claimed invention as applied to claim 1, except for the etch stop layer comprises a dielectric antireflective coating layer as cited in current claim 2.

Ho shows that the etch stop layer comprises a dielectric antireflective coating layer 416.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to the etch stop layer comprises a dielectric antireflective coating layer, as taught by Ho in order to obtain results in minimal bowing of the vias and trenches formed by the etch process, good etch profiles, good resist selectivity, good etch rates, and good etch uniformity across the wafer [0038].

**Claims 6- 10, see Reasons for Indication of Allowable Subject Matter.**

**Set of claims 11-20.**

**Claims 11, 13 and 14 are rejected under 35 USC 102 (b) as being anticipated by Schwalke (5496765).**

Schwalke teaches a method for creating contact holes having a uniform diameter from top to bottom, comprising the steps of:

- (a) forming a dielectric layer 3 over a bottom layer 2;
- (b) forming an etch stop layer 42/41 over the dielectric layer 3;
- (c) forming a patterned photoresist layer 5 above the etch stop layer 42/41;
- (d) etching contact holes into the dielectric layer 3 and the etch stop layer using the patterned photoresist layer as a template to expose a surface of the bottom layer (figs. 1- 2)
- (e) removing the patterned photoresist layer 5;
- (f) forming a spacer material layer 10 over the etch stop layer 42/41 and into the contact holes (fig. 6); and
- (g) removing the spacer material layer 10 from over the etch stop layer 42/41, wherein the spacer material 101 remains in the contact holes. (fig. 7)

**Regarding claim 13, wherein the spacer material (silicon oxide , see col 5, line 15) is etched 20 or more times as fast as the stop etch layer 42/41 ( see col 4, line 12) in step (g).**

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**Regarding claim 14**, wherein the stop etch layer 42/41 adjacent to the contact hole is not removed in step (g). (fig. 7).

**Claim 12 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Schwalke in view of Ho (US 2002/0110992 A1) .**

Schwalke teaches all claimed invention as applied to claim 11, except for the etch stop layer comprises a dielectric antireflective coating layer as cited in current claim 12.

Ho shows that the etch stop layer comprises a dielectric antireflective coating layer 416.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to the etch stop layer comprises a dielectric antireflective coating layer, as taught by Ho in order to obtain results in minimal bowing of the vias and trenches formed by the etch process, good etch profiles, good resist selectivity, good etch rates, and good etch uniformity across the wafer [0038].

**Claims 16- 19**, see Reasons for Indication of Allowable Subject Matter.

**Claim 20**, see Claim objection.



**Set of claims 21-24**

**Claims 21- 23 are rejected under 35 USC 102 (b) as being anticipated by Lin et al. (6096594).**

Lin et al. shows a method of forming a contact hole with a spacer, comprising the steps of

(a) providing a substrate 38 covered by a first dielectric layer 40/36 and an etch stop layer 42;

(b) etching the etch stop layer 42 and the first dielectric layer 40/36 to form a contact hole 46 exposing the substrate 38;

(c) forming a conformal second dielectric layer 50 on the etch stop layer 42 and in the contact hole 46; and

(d) etching the second dielectric layer 50 to form a spacer on the sidewall of the contact hole, wherein etching of the second dielectric layer 40 (silicon nitride, col ) occurs at a faster rate than etching of the etch stop layer 42(silicon oxide)..

**Regarding claim 22**, wherein the second dielectric layer 50 (silicon nitride, col 3, line 61) is etched 20 or more times as fast as the etch stop layer 42 (silicon Oxide, col 3, line 34) in step (d).

**Regarding claim 23**, wherein the etch stop layer adjacent to the contact hole is not removed in step (d). (fig. 4D).

**Claim 24 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Lin et al. in view of Ho (US 2002/0110992 A1) .**

Lin et al. teaches all claimed invention as applied to claim 21, except for the etch stop layer comprises a dielectric antireflective coating layer as cited in current claim 24.

Ho shows that the etch stop layer comprises a dielectric antireflective coating layer 416.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to the etch stop layer comprises a dielectric antireflective coating layer, as taught by Ho in order to obtain results in minimal bowing of the vias and trenches formed by the etch process, good etch profiles, good resist selectivity, good etch rates, and good etch uniformity across the wafer [0038].

***Reasons for Indication of Allowable Subject Matter***

**Claim 6- 10 and 15- 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, since the prior**

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made of record and considered pertinent to the applicant's disclosure does not teach or suggest the claimed limitations. Lin et al. (U.S. Patent No. 6096594), Ho (U.S. Patent No. 2002/0110992 A1) and Schwalke (U.S. Patent No. 5496765), taken individually or in combination, do not teach the claimed invention having the step uses an etching gas comprising oxygen, fluorocarbon gas and carbon oxide as cited in claim 6 and **(Regarding claims 15-19)** the step of removing the spacer material layer further comprises anisotropically etching the spacer material layer in an etch chamber using an etching gas comprising oxygen, fluorocarbon gas and carbon oxide as cited in claim 15.

When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

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*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is (571) 272-1784. The examiner can normally be reached on Monday-Friday 8:00am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (571) 272-1787. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Dung A. Le  
P. Examiner

A handwritten signature in black ink, appearing to be 'DLe', written over a horizontal line.